Title: Geometric Petting Zoo

Brief Overview:

Students will apply their knowledge of area, perimeter, and circular geometry (circumference, radius and diameter) in order to plan a petting zoo and complete activities. The end result will be a map of their design plan, and a written letter to persuade the mayor to select their plan.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

- **Content Standards**

Number and Operations

- *Understand meanings of operations and how they relate to one another; understand various meanings of multiplication; understand the effects of multiplying and dividing whole numbers; identify and use relationships between operations, such as division as the inverse of multiplication, to solve problems; and understand and use properties of operations, such as the distributivity of multiplication over addition.*

Geometry

- *Use visualization, spatial reasoning, and geometric modeling to solve problems; build and draw geometric objects; create and describe mental images of objects, patterns, and paths; identify and draw a two-dimensional representation of a three-dimensional object; use geometric models to solve problems in other areas of mathematics, such as number and measurement; and recognize geometric ideas and relationships and apply them to other disciplines and to problems that arise in the classroom or in everyday life.*

Measurement

- *Understand measurable attributes of objects and the units, systems, and processes of measurement;understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute; understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems; and explore what happens to measurements of a two-dimensional shape such as its perimeter and area when the shape is changed in some way.*
- *Apply appropriate techniques, tools, and formulas to determine measurements; select and apply appropriate standard units and tools to measure length, area, and time; and develop, understand, and use formulas to find the area of rectangles.*

Data Analysis and Probability

- *Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them; represent data using tables and graphs such as line plots, bar graphs, and line graphs; and recognize the differences in representing categorical and numerical data.*

- **Process Standards**

Problem Solving

- *Instructional programs from prekindergarten through grade 12 should enable all students to build new mathematical knowledge through problem solving; solve problems that arise in mathematics and in other contexts; apply and adapt a variety of appropriate strategies to solve problems; and monitor and reflect on the process of mathematical problem solving.*

Reasoning and Proof

- *Instructional programs from prekindergarten through grade 12 should enable all students to recognize reasoning and proof as fundamental aspects of mathematics; make and investigate mathematical conjectures; develop and evaluate mathematical arguments and proofs; and select and use various types of reasoning and methods of proof.*

Communication

- *Instructional programs from prekindergarten through grade 12 should enable all students to organize and consolidate their mathematical thinking through communication; communicate their mathematical thinking coherently and clearly to peers, teachers, and others; analyze and evaluate the mathematical thinking and strategies of others; and use the language of mathematics to express mathematical ideas precisely.*

Connections

- *Instructional programs from prekindergarten through grade 12 should enable all students to recognize and use connections among mathematical ideas; understand how mathematical ideas interconnect and build on one another to produce a coherent whole; and recognize and apply mathematics in contexts outside of mathematics.*

Representation

- *Instructional programs from prekindergarten through grade 12 should enable all students to create and use representations to organize, record, and communicate mathematical ideas; select, apply, and translate among mathematical representations to solve problems; and use representations to model and interpret physical, social, and mathematical phenomena.*

Grade/Level:

Grades 3-5

Duration/Length:

Four class periods (approximately 60 mins. each)

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Working in cooperative groups
- Understanding of area and perimeter
- Measurement (metric ruler)
- Elements of a map
- Writing complete sentences

Student Outcomes:

Students will:

- Produce a two dimensional model (map) to visually represent information
- Measure using a metric ruler (centimeters)
- Write a persuasive letter
- Work cooperatively to edit persuasive letters

Materials/Resources/Printed Materials:

- Pencil
- Crayons/Markers
- Scissors
- Glue
- Ruler
- Compass
- Chalkboard or Overhead Projector
- Teacher Resource Sheets #1-7
- Student Resource Sheets #1-11

Development/Procedures:

Day 1

- Ask students how they think this school (or any other building example) was created. Write on the chalkboard or overhead student responses. Ask students to sequence the events in the construction of a building (i.e. First, the builder would need to assess the needs of the faculty. Next, they need to create a plan of the building. Then gather materials, construct, etc.)

- Give students a copy of Student Resource Sheet 1, "The Geometric Petting Zoo" and read prompt aloud to students.

  Distribute Student Resource Sheet 2, "Animal Living Space Models" and metric rulers. Have students locate a centimeter on the ruler. Next, show students a metric ruler and explain to them that one centimeter will be the equivalent of one meter on the scale used for Student Resource Sheet 2. Have students read the directions at the bottom of the page. Allow time for students to measure and label the squares and rectangles. Have students turn this worksheet into the teacher to review (the students will cut out the shapes on the following day). Answers can be found on Teacher Resource Sheet 1.

Day 2

- Teacher returns Student Resource Sheet 2 and gives students a few minutes to cut out the models.

- Distribute Student Resource Sheet 3, and review elements of a map (i.e., scale, key, compass rose, etc.).

- Distribute Student Resource Sheet 4, "Grading Criteria for Map," so that the students can use this as a guide for making their maps. Teachers will use Teacher Resource Sheet 2 to grade Student Resource Sheet 3.

- Allow time for students to create a map of their "petting zoo" design plan using the animal models from Student Resource Sheet 2.

Day 3

- Review parts of a persuasive letter. Have students create their own graphic organizer to highlight positive aspects of their maps' design to use as a guideline for developing their persuasive letters. Provide time for the students to complete this exercise (approximately 10 minutes).

- Distribute Student Resource Sheet 5, "Writing Prompt for the Geometric Petting Zoo," and read it aloud to the students. Use Teacher Resource Sheet 3, "Writing Rubric", as a transparency to explain how the writing will be scored.

- Give students a copy of Student Resource Sheet 6a or Student Resource Sheet 6b, "Persuasive Letter Form." Students will use the remaining time to develop the rough draft of their persuasive letter.

Day 4

- Distribute Student Resource Sheet 7, "Peer Review Checklist for Writing," and have students work in groups of 2 to 3 to edit each other's paper.

- Students will revise their letters and submit these revised versions of their letters to their teacher, who will edit and return them. Students will then complete and turn in their final copy.

Performance Assessment:

- Students will be assessed through their creation of the design plan maps, Student Resource Sheet 3 and the persuasive letters that they will write to the mayor, Student Resource Sheet 6 using the rubrics provided.

Extension/Follow Up:

- Display student design maps for school observation
- Complete worksheet on time, money and problem solving Student Resource Sheet 8, "Petting Zoo Math." Answers are on Teacher Resource Sheet 4.
- Complete worksheets on displaying data on a bar graph Student Resource Sheet 9, "Petting Zoo Attendance" and Student Resource Sheet 10. you may want to make a transparency of Teacher Resource Sheet 5, "Bar Graph Grading Rubric", and display it to the students.
- Investigate circular geometry with students using Student Resource Sheet 11, "The Pony Ring." Answers are on Teacher Resource Sheet 6.
- Explore the relationship between perimeter and area using geometric formulas, Student Resource Sheet 12, "The New Arrival." Answers are on Teacher Resource Sheet 7.

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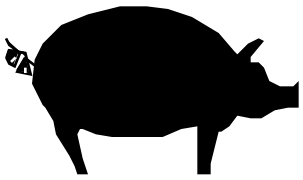
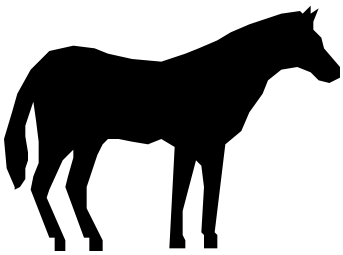
The Geometric Petting Zoo

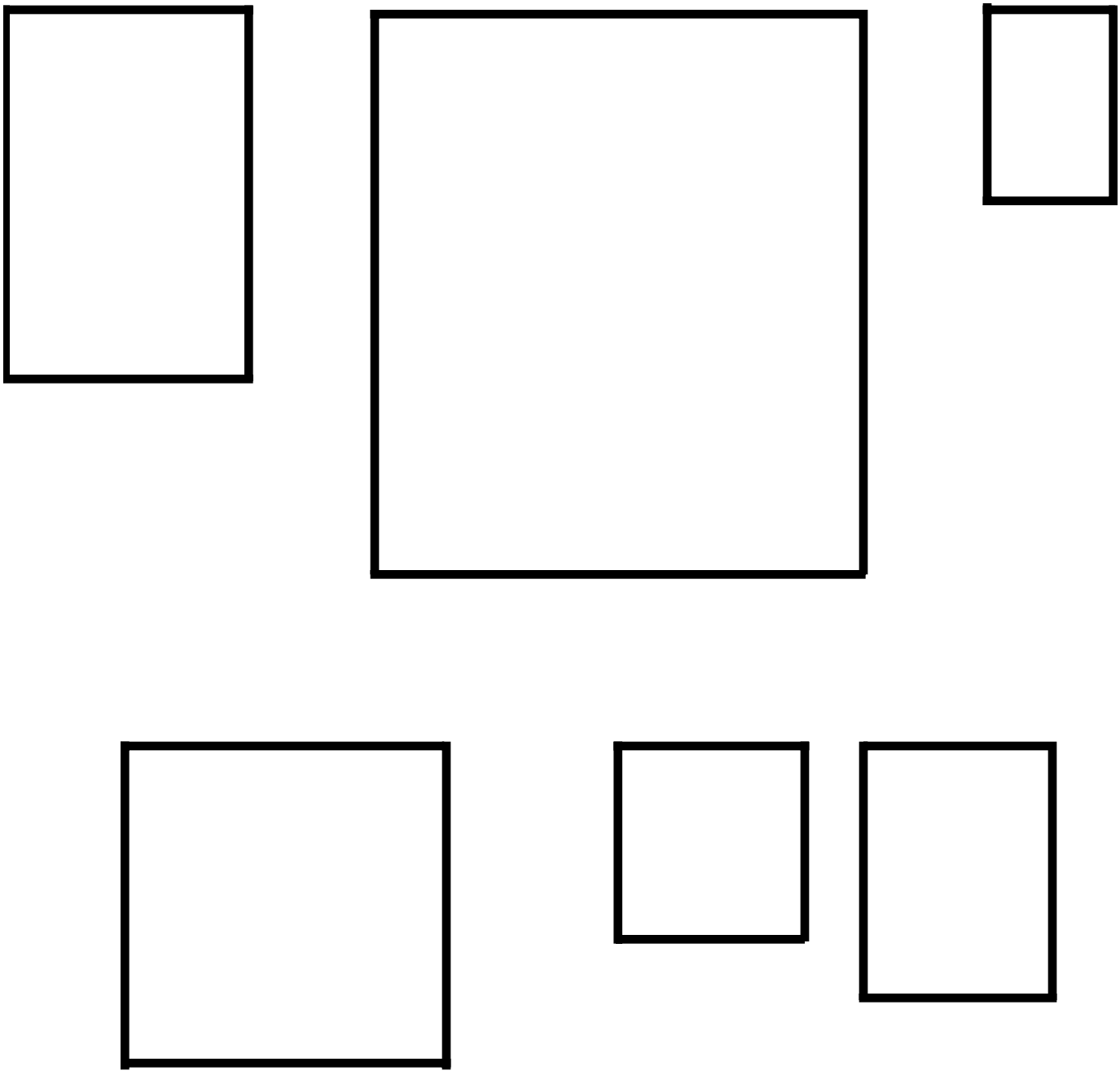
The mayor has announced he will be building a petting zoo in your community. He has asked for students from your school to help design the new zoo. Using the following information you will create a map showing your suggestion and will write the mayor persuading him to use your design. The petting zoo will house six animals. The goat will need an area 4m x 6m. The snake's cage requires an area of 2m X 3m. The rabbits will need an area of 3m x 3m for their space. The sheep's area must be 5m x 5m. There will be a pot-bellied pig in an area 3m x 4m. The petting zoo will offer pony rides in an area that is 8m x 9m. The zoo will also contain at least two water fountains that will measure 1m x 1m. All areas must be at least 2 meters apart to allow room for walk ways. You may add trees and benches where you believe they should go. Keep in mind trees will require an area of 1m x 1m and benches will require an area of 2m x 1m.





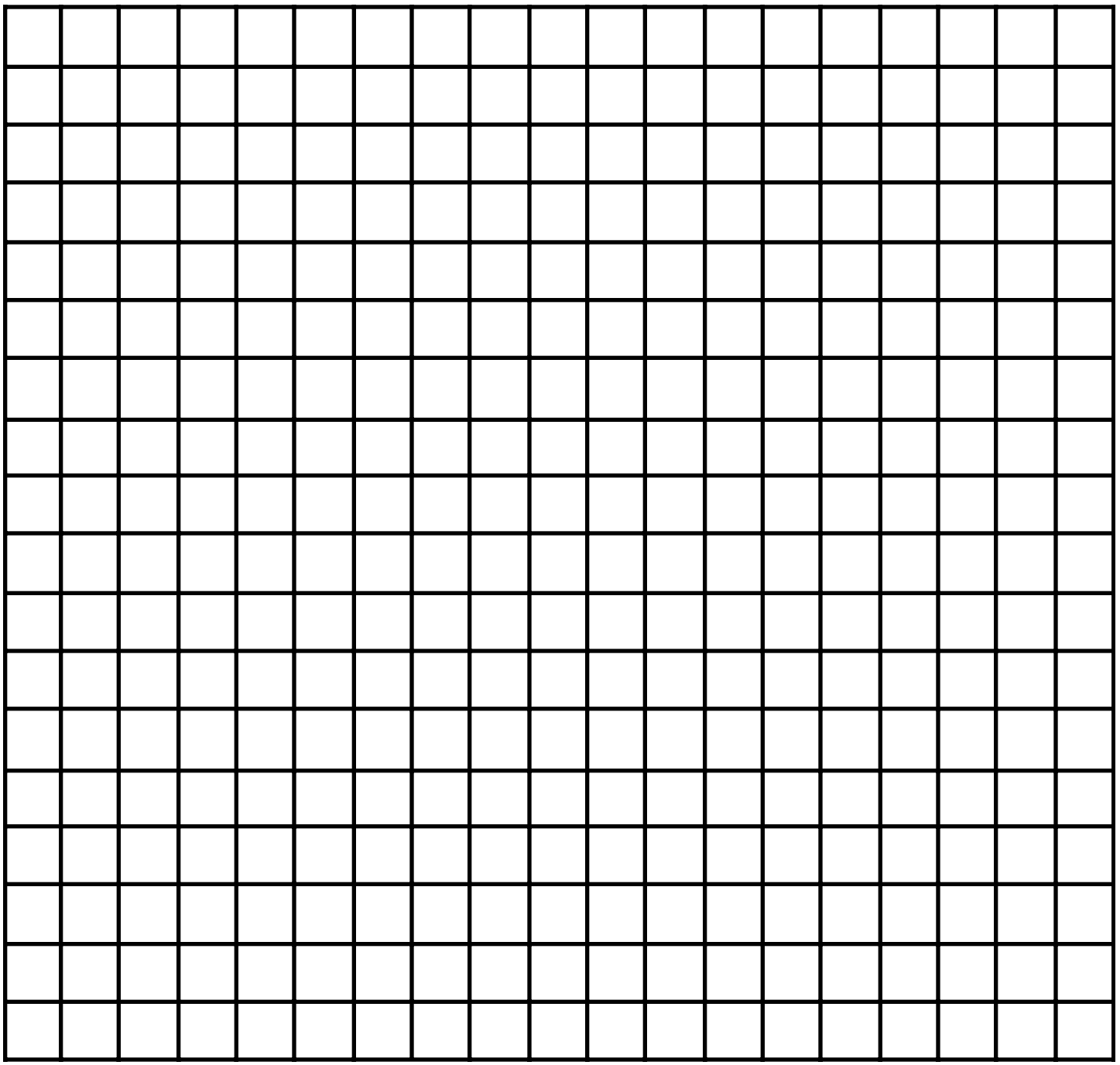
Animal Living Space Models

Scale: 1 centimeter = 1 meter



Directions:
Above are models of each animal's living space. Use your graphic organizer and a ruler to determine which area belongs to each animal. Label each box with the appropriate name. Cut out these models to aid you in creating your design.

Name_____ Student Resource Sheet 3



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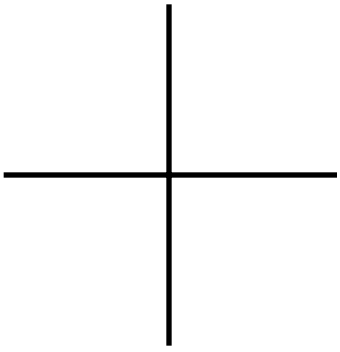


Student Name: _____

Grading Criteria for Map

Each item on the map is worth one point if present for a total of up to ten points.

0 1 Title

0 1 Handwriting is legible.

0 1 Water fountains are present and labeled.

0 1 All animal habitat areas are present and labeled.

0 1 Scale showing 1 cm. = 1 m. is present.

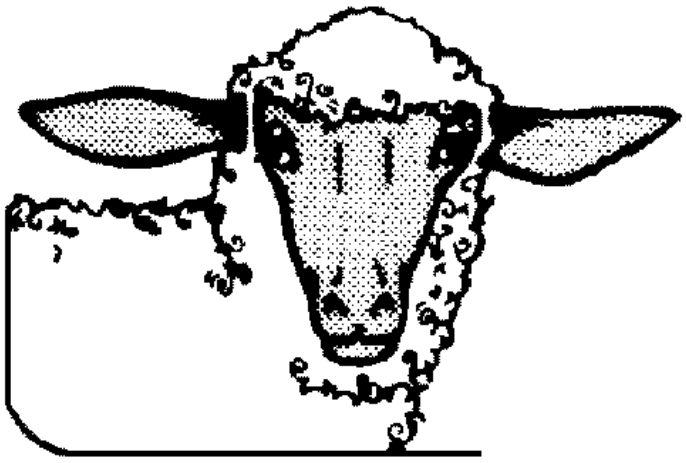
0 1 Legend is present on map with appropriate symbols shown.

0 1 All areas are 2 meters apart to allow room for walkways.

0 1 Map is oriented correctly and compass rose is present.

0 1 Map is neat in appearance.

0 1 Student's heading is appropriately placed.



Writing Prompt for the Geometric Petting Zoo

You have created a plan showing your design for the new petting zoo. Now, it is your job to write a letter to the mayor persuading him to choose your plan to use in building the new zoo. In your persuasive letter, you will need to include the following:

- ◇ **Clear and legible handwriting**
- ◇ **Complete sentences**
- ◇ **Correct capitalization, usage, punctuation, and spelling (CUPS)**
- ◇ **Correct letter format**
- ◇ **Clear explanation of your zoo design plan**

Student Resource Sheet 6a

Persuasive Letter Form

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Date

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Closing

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Your Name

Persuasive Letter Form

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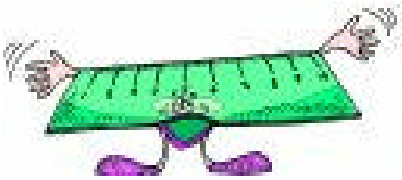
Peer Review Checklist for Writing

Place check in box when you complete each item below.

- ☐ 1. Each sentence began with a capital letter.
- ☐ 2. Each sentence ended with the correct punctuation mark.
- ☐ 3. Sentences were clear and complete.
- ☐ 4. Topic sentence and closing sentence are present in each paragraph.
- ☐ 5. At least three supporting details are in each paragraph.
- ☐ 6. All the parts of a persuasive letter are present.
- ☐ 7. My handwriting is legible.



Supplemental Activities for the Geometric Petting Zoo

Student Name _____

Petting Zoo Math

Directions: Solve the problems for the petting zoo keeper, Mrs. Hernandez.

Mrs. Hernandez pays her assistant $9.00 an hour to work with the animals. If the assistant works 8:00 A.M. to 1:00 P.M. on Monday, Tuesday, Friday, and 8:00 A.M. to 4:00 P.M. on Saturday and Sunday, how much did she earn?

Explain how you solved the problem.

_____
_____
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_____
_____

Student Name _____

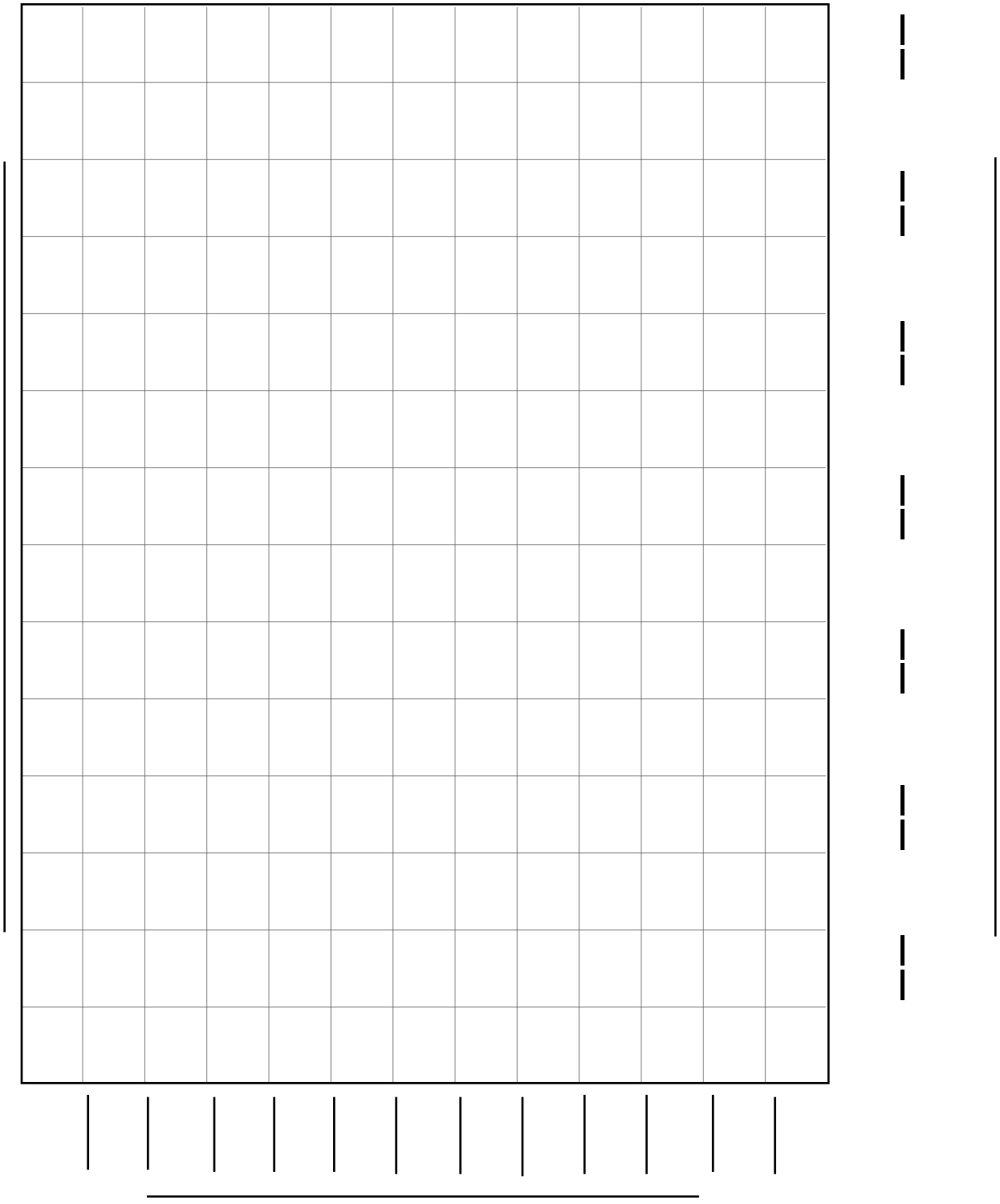
PETTING ZOO ATTENDANCE

Directions: Use the information below to construct a bar graph on the following sheet.

The petting zoo attendance for the first week it was opened was as follows:

Sunday	128	people
Monday	32	people
Tuesday	46	people
Wednesday	39	people
Thursday	65	people
Friday	51	people
Saturday	106	people

Student Resource Sheet 10



Name_____ Student Resource Sheet 11

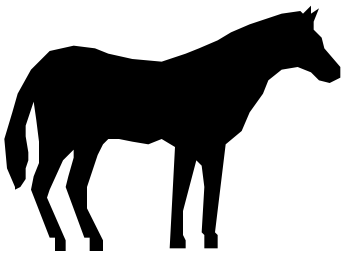
The Pony Ring

Pony rides will be given in an area that is 8 m x 9 m. A circular ring needs to be placed in the middle of this area. Draw the ring and measure and label its diameter and radius. Next, find the circumference of the ring. Circumference = p x diameter (p = 3.14).

Diameter =

Radius=

Circumference=



If each pony is 2 meters long and at least 3 meters must be placed between each pony, what is the greatest number of ponies that can walk in the ring at one time?

It takes each pony 2 minutes to complete one lap around the ring. How many minutes will it take a pony to complete 7 laps? How many laps can be traveled in one hour?

Name _____

The New Arrival

You have been given the opportunity to choose a new animal to bring to the petting zoo. The animal may be any animal of your choice. Write the name of your animal on the line below.

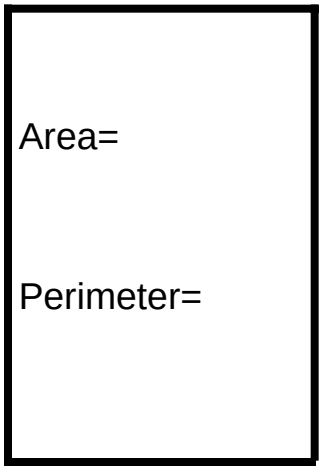
_____

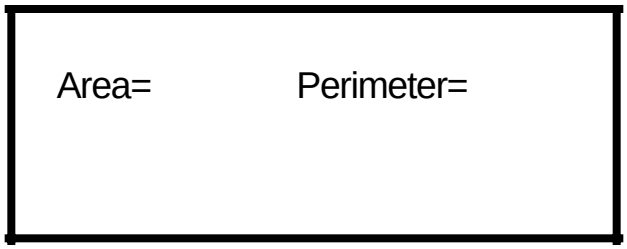
There are three plots of land available to house your new animal. You must choose a plot that is most appropriate for your animal. Measure the area and perimeter of each plot to help you make your decision.

Scale 1 cm = 1 m

A

C





B

Which plot will you choose to house you animal? On the lines below explain which plot is most appropriate and why.

_____

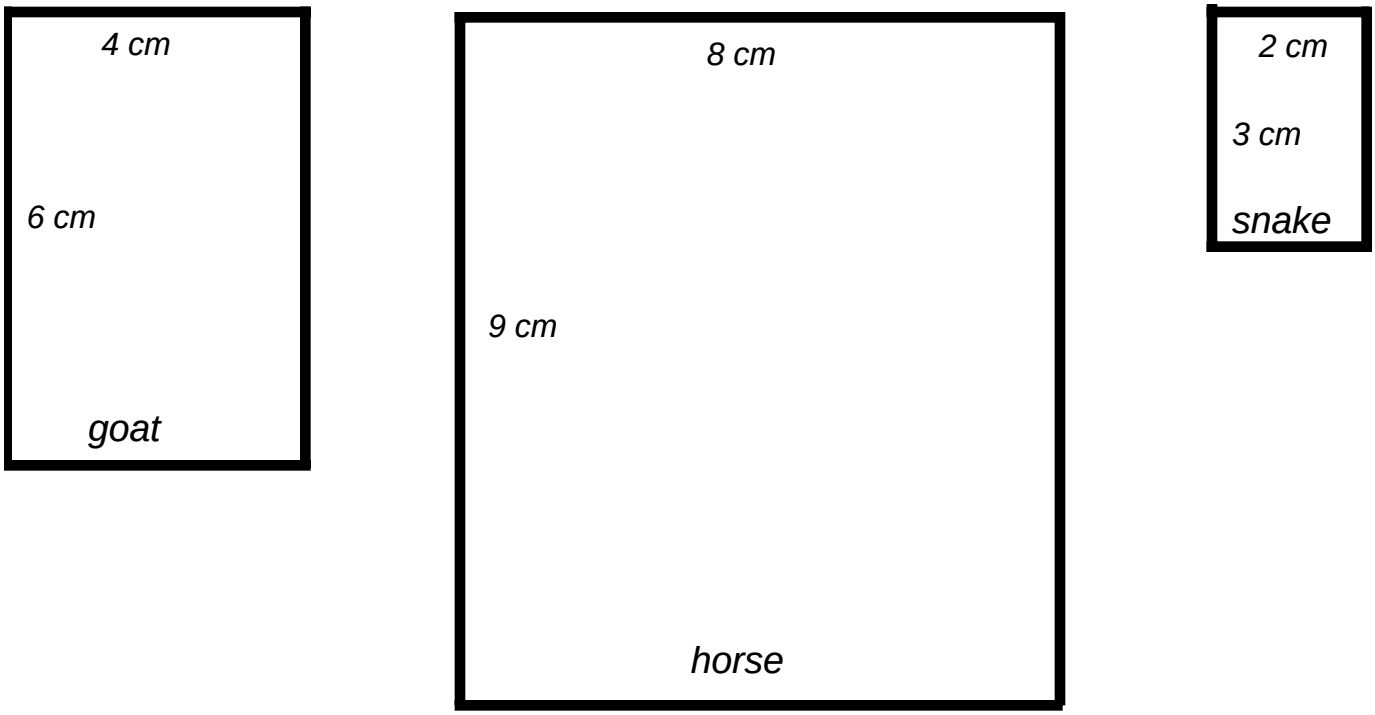
_____

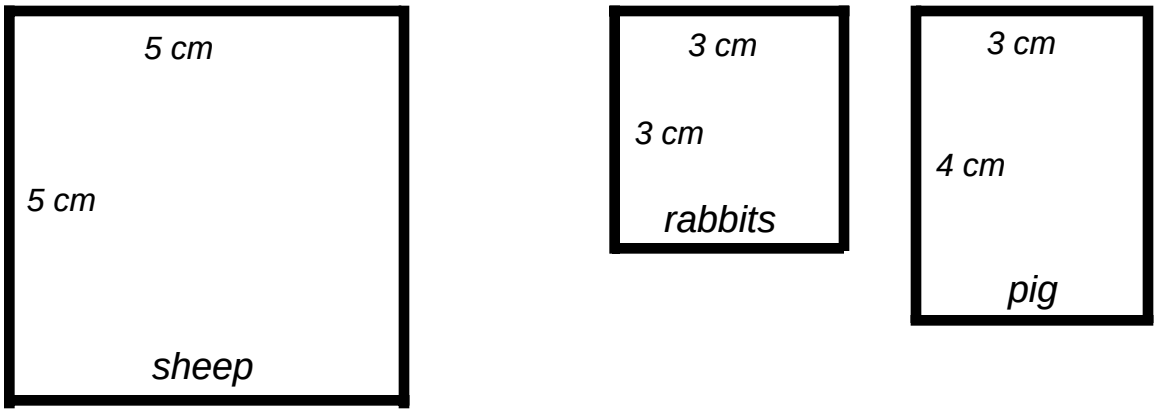
_____

_____

Animal Living Space Models *Teacher Resource Sheet 1*

Scale : 1 centimeter = 1 meter





Directions:

Above are models of each animal's living space. Use your graphic organizer and a ruler to determine which area belongs to each animal. Label each box with the appropriate name. Cut out these models to aid you in creating your design.

Student Name: _____

Grading Criteria for Map

Each item on the map is worth one point if present for a total of up to ten points.

0	1	Title
0	1	Handwriting is legible.
0	1	Water fountains are present and labeled.
0	1	All animal habitat areas are present and labeled.
0	1	Scale showing 1 cm. = 1 m. is present.
0	1	Legend is present on map with appropriate symbols shown.
0	1	All areas are 2 meters apart to allow room for walkways.
0	1	Map is oriented correctly and compass rose is present.
0	1	Map is neat in appearance.
0	1	Student’s heading is appropriately placed.

Student Name: _____

WRITING RUBRIC
(FOR STUDENT RESOURCE)

3 Points:

Handwriting is clear and legible.
Correct capitalization, usage, punctuation, and spelling (CUPS).
Contains all parts of a friendly letter.
Complete sentences are used.
Vocabulary is varied.
Clear explanation of why their map design should be used.

2 Points:

Handwriting is somewhat clear and understandable.
Minor inaccuracies in capitalization, usage, punctuation, and spelling (CUPS).
Most parts of a friendly letter are present.
Minor errors in sentence structure.
Reasonably clear explanation of why their map design should be used.

1 Point:

Handwriting is not clear and understandable.
Serious inaccuracies in capitalization, usage, punctuation, and spelling (CUPS).
Numerous errors in friendly letter form.
Sentence Structure contains serious inaccuracies.
The explanation of why their map design should be accepted is unclear or illogical.

Student Name _____

Petting Zoo Math

Directions: Solve the problems for the petting zoo keeper, Mrs. Hernandez.

Mrs. Hernandez pays her assistant $9.00 an hour to work with the animals. If the assistant works 8:00 A.M. to 1:00 P.M. on Monday, Tuesday, Friday, and 8:00 A.M. to 4:00 P.M. on Saturday and Sunday, how much did she earn?

Answer: $279.00

Explain how you solved the problem.

Answers will vary. Students should discuss how they calculated time and use number sentences in explanation (for example: 3 x 5 = 15, 2 x 8 = 16, 15 + 16 = 31). In addition, they should explain how they took the 31 hours and multiplied it by $9.00 an hour, and use the number sentence 31 x $9.00 =$279.00

Student Name _____

Bar Graph Grading Rubric

Each item on the bar graph is worth one point if done correctly for a total of ten points.

0	1	Title placed above bar graph.
0	1	x axis is labeled correctly.
0	1	y axis is labeled correctly.
0	1	Numbers are properly spaced and equal units.
0	1	Numbers are written on the lines.
0	1	Handwriting is legible.
0	1	Bar graph lines are straight.
0	1	Data represented is accurate.
0	1	Bars do not touch.
0	1	Equal spacing between bars.

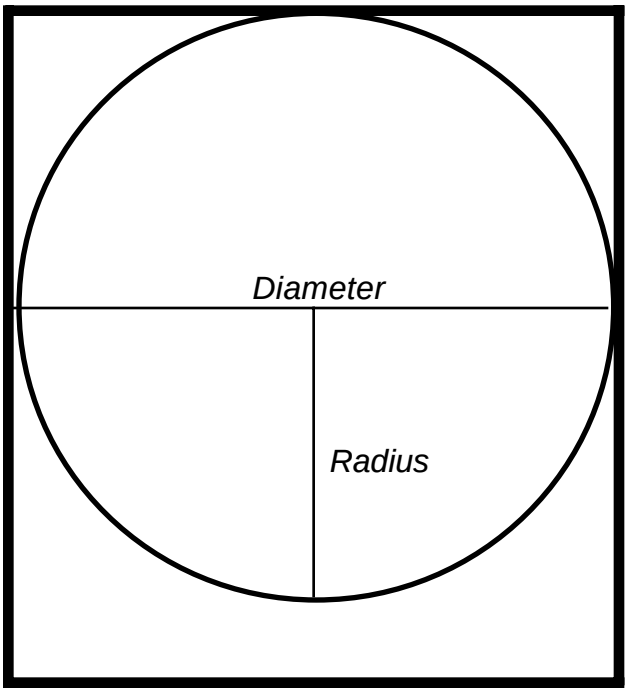
Total Points: _____

Name _____

The Pony Ring

Pony rides will be given in an area that is 8 m x 9 m. A circular ring needs to be placed in the middle of this area. Draw the ring and measure and label its diameter and radius. Next, find the circumference of the ring. Circumference = π x diameter (π = 3.14).

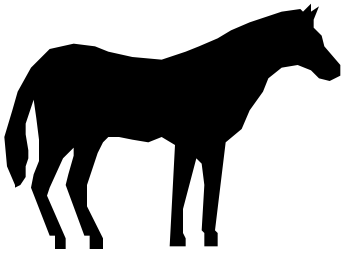
Answers may vary depending on the size of each student's circle.



Diameter = *8 cm*

Radius= *4 cm*

Circumference= *25.12 cm*



If each pony is 2 meters long and at least 3 meters must be placed between each pony, what is the greatest number of ponies that can walk in the ring at one time?

Five horses if the circumference is 25. The answer can be found by dividing the circumference by five.

It takes each pony 2 minutes to complete one lap around the ring. How many minutes will it take a pony to complete 7 laps? How many laps can be traveled in one hour?

It will take fourteen minutes for a pony to complete seven laps (7 multiplied by 2 is 14). Thirty laps can be traveled in one hour (60 minutes in an hour, 60 divided by 2 is thirty)

Name _____

Teacher Resource Sheet 7

The New Arrival

You have been given the opportunity to choose a new animal to bring to the petting zoo. The animal may be any animal of your choice. Write the name of your animal on the line below.

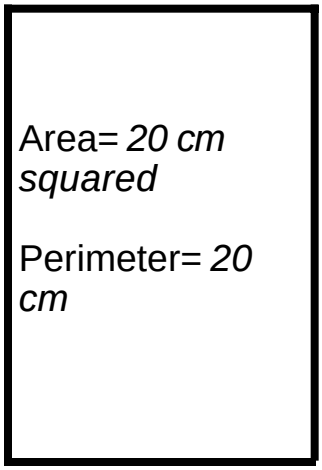
Answers will vary.

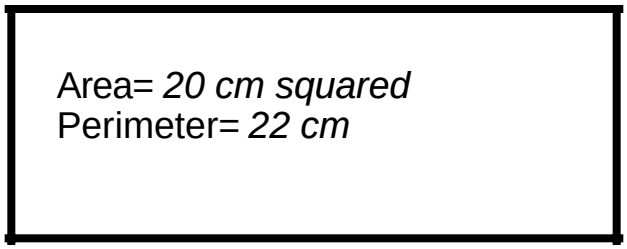
There are three plots of land available to house your new animal. You must choose a plot that is most appropriate for your animal. Measure the area and perimeter of each plot to help you make your decision.

Scale 1 cm = 1 m

A

C





B

Which plot will you choose to house you animal? On the lines below explain which plot is most appropriate and why.

Answers will vary.